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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/696,465	10/29/2003	Yong-Kuk Jeong	SAM-0477	6009

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Anthony P. Onello, Jr.
MILLS & ONELLO LLP
Suite 605
Eleven Beacon Street
Boston, MA 02108

EXAMINER	
BLUM, DAVID S	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 05/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/696,465	JEONG ET AL.	
	Examiner	Art Unit	
	David S. Blum	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 April 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *29 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

This is in response to the RCE and amendment filed 4/25/06.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-18 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 1 and 16 (and therefore all dependent claims) contain the limitation "forming a second electrode...without curing the second dielectric layer. The specification as originally presented offers no support for this limitation. The specification (page 10 lines 23-25) discloses that the second dielectric layer is deposited without performing an additional curing process. This does not preclude the practice of performing a subsequent curing step, separate or in conjunction with another step. The issue of subsequent curing of the second dielectric layer is not discussed in the instant specification. The subsequent step of forming an electrode of

RuO2 or IrO2 by CVD or ALD (page 10 lines 15-20, 30-31) would include an oxidizing atmosphere and is a curing step as taught in Basceri (see below). The specification (page 10 lines 23-25) cannot be interpreted as allowing a cure during deposition of the electrode but not after deposition of the electrode but only that the deposition of the electrode does not include a curing step. The examiner notes that the amendment moves to correct the previous US 35 112 rejection, but does not correct the matter. It is suggested that "without curing the second dielectric layer" be amended to "without having previously cured the second dielectric layer" or "without curing the dielectric layer during the formation of a second electrode".

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 1-12 and 14-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chung (US 6,884,675) in view of Basceri (US 6,673,669).

Chung teaches all of the positive steps of claims 1-12 and 14-18 except for forming a second electrode on the second dielectric layer without curing the second dielectric layer.

Regarding claim 1, Chung forms a first electrode on a semiconductor substrate (column 3 lines 8-9), a first dielectric layer on the first electrode (column 3 lines 8-9), cures the first dielectric layer in an atmosphere containing oxygen (column 5 line 32, ozone curing after Tantalum deposition), depositing a second dielectric layer on the cured first dielectric layer using only a source gas (column 5 lines 34-39, second sequence of tantalum precursors, purge gas, flow of reactant gas). Chung teaches curing the second dielectric layer prior to forming the second electrode. Basceri also teaches curing the dielectric layer prior to forming the second electrode, or as an alternate embodiment, depositing the second electrode on an uncured dielectric by depositing the electrode with an oxygen atmosphere or diffusing oxygen through the second electrode after deposition (column 5 line 32-column 6 line 4). Basceri teaches these methods better fill oxygen vacancies that would migrate toward the dielectric/electrode interface. Thus Basceri not only teaches forming an electrode on an uncured dielectric layer as an alternative to forming the electrode on a cured dielectric layer, Basceri teaches an advantage for doing so. As Chung deposits the material by CVD or other methods, it is obvious that Chung introduces the substrate into a deposition chamber, supplies a source gas, and heats the substrate. Chung deposits a stable dielectric layer.

Regarding claim 2, the first dielectric layer is formed using only a source gas without a reactant gas (column 5 lines 35-40, ozone is used to cure the deposited layer).

Regarding claim 3, the first and second dielectric layers are formed by CVD (chemical vapor deposition) (column 5 line 7).

Regarding claim 4, the first and second dielectric layers are formed by ALD (atomic layer deposition) (column 5 line 8).

Regarding claim 5, the source gas includes oxygen (column 4 lines 11-13).

Regarding claim 6, the first and second dielectric layers are deposited at 100-600 degrees C. (column 3 line 44).

Regarding claim 7, the first dielectric layer is deposited to a thickness of 5-200 A (Table I, 103-244 A) and the second dielectric layer is deposited to a thickness of 5-3000 A (Table I 102-228 A).

Regarding claim 8, the source gas is Ta(OC2H5)5 or Ta(OCH3)5 (column 4 lines 12-13).

Regarding claim 9, the first dielectric layer is formed of Ta2O5 using CVD (column 5 lines 7 and 38).

Regarding claim 10, the second dielectric layer is formed of Ta2O5 using CVD (column 5 lines 7 and 38).

Regarding claim 11, the first and second dielectric layers are deposited in-situ (column 5 lines 13-39), Chung teaches repeating the deposition steps without removal from the chamber or a break in the process, thus it is obvious the two layers are formed in-situ.

Regarding claim 12, the atmosphere containing oxygen is O3 (column 5 line 36, ozone is O3).

Regarding claim 14, the first electrode is one of Ru, Pt, Ir (column 4 line 37) and the second electrode is TiN or TaN (column 5 line 67-column 6 line 1).

Regarding claim 15, the first and second dielectric layer is Ta2O5 (column 5 line 38).

Regarding claim 16, Chung forms a first electrode on a semiconductor substrate (column 3 lines 8-9), a first Ta2O5 layer is formed on the first electrode (column 3 lines 8-9), cures the first dielectric layer in an atmosphere containing O3 (column 5 line 32, ozone curing after Tantalum deposition), depositing a second Ta2O5 layer on the cured

first dielectric layer using only a source gas (column 5 lines 34-39, second sequence of tantalum precursors, purge gas, flow of reactant gas). Chung teaches curing the second dielectric layer prior to forming the second electrode. Basceri also teaches curing the dielectric layer prior to forming the second electrode, or as an alternate embodiment, depositing the second electrode on an uncured dielectric by depositing the electrode with an oxygen atmosphere or diffusing oxygen through the second electrode after deposition (column 5 line 32-column 6 line 4). Basceri teaches these methods better fill oxygen vacancies that would migrate toward the dielectric/electrode interface. Thus Basceri not only teaches forming an electrode on an uncured dielectric layer as an alternative to forming the electrode on a cured dielectric layer, Basceri teaches an advantage for doing so. As Chung deposits the material by CVD or other methods, it is obvious that Chung introduces the substrate into a deposition chamber, supplies a source gas, and heats the substrate. Chung deposits a stable dielectric layer.

Regarding claim 17, the first Ta2O5 layer is formed using Ta(OC2H5)5 without a reactant gas (column 4 lines 13-14).

Regarding claim 18, the first and second Ta2O5 layers are formed by CVD (chemical vapor deposition) (column 5 line 7).

It would be obvious to one skilled in the requisite art at the time of the invention to modify Chung by forming the electrode upon an uncured (Ta2O5) dielectric as taught by

Basceri to better fill oxygen vacancies that would migrate toward the dielectric/electrode interface.

5. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chung (US 6,884,675) in view of Basceri (US 6,673,669)and in further view of Narwankar (US 6,677,254).

Chung and Basceri teach all of the positive steps of claim 13 as recited above in regard to claim 1, except for forming the atmosphere containing oxygen being electron resonance or an RF plasma of O2 or N2O.

Regarding claim 13, Chung is silent as to the source of O3, and Basceri teaches using O2, O3, or N2O, but does not teach electron resonance or an RF plasma as the method of producing the gas (column 5 line 62-column 6 line 4, suggesting thermal heating). Narwankar teaches supplying the gas (O2) as a thermal heated operation or in an RF plasma (microwaves column 7 lines 5-20), giving the two heating methods an art recognized equivalence for this operation.

It would be obvious to one skilled in the requisite art at the time of the invention to modify Chung and Basceri by using RF plasma oxygen as taught by Narwankar to be an art recognized equivalent to thermal oxidation for this operation.

Response to Arguments

6. Applicant's arguments filed 4/29/06 have been fully considered but they are not persuasive.

The applicant argues that Chung fails to teach introducing the semiconductor substrate into a deposition chamber, supplying a source gas to the chamber, heating the substrate such that a stable dielectric layer is deposited. The examiner disagrees. All of these steps are taught or clearly suggested by Chung. Although Chung does not teach introducing the substrate into a chamber, as Chung teaches deposition, it must be done in a chamber and the substrate must be placed in it. All other steps are taught. Chung argues the same for the second Ta2O5 layer, but Chung again teaches or suggests these limitations. The applicant argues that Chung uses ozone gas to treat the tantalum to form the stable tantalum oxide, but does not teach heating to form the stable oxide. The examiner disagrees, the substrate is heated and the use of ozone to oxidize the tantalum reads on the instant claims.

The applicant argues that Basceri does not teach or suggest introducing the semiconductor substrate into a deposition chamber, supplying a source gas to the chamber, heating the substrate such that a stable dielectric layer is deposited. Without discussing Basceri, as Chung teaches the limitations, that is all that is necessary.

The applicant argues that neither Chung nor Basceri does not teach or suggest introducing the semiconductor substrate into a deposition chamber, supplying a source gas to the chamber, heating the substrate such that a stable dielectric layer is deposited. As above, the examiner states that Chung reads on these limitations.

The applicant argues that Narwankar does not teach or suggest introducing the semiconductor substrate into a deposition chamber, supplying a source gas to the chamber, heating the substrate such that a stable dielectric layer is deposited. Without discussing Narwankar, as Chung teaches the limitations, that is all that is necessary.

Conclusion

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to David S. Blum whose telephone number is (571)-272-1687) and e-mail address is David.blum@USPTO.gov .

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead Jr., can be reached at (571)-272-1702. Our facsimile number all patent correspondence to be entered into an application is (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

David S. Blum

May 15, 2006